Phanerozoic komatiites from a reservoir at the core-mantle boundary

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The mantle plume hypothesis is widely accepted for the formation of large igneous provinces and many modern-day hotspot volcanoes. Global tomography and geodynamic models suggest that mantle plumes are connected to the margins of thermo-chemical domains in the deep Earth. Thus, plume-related magmas can provide evidence on the composition and evolution of their deep Earth. Petrological studies suggest that plume-derived melts originate at high mantle temperatures (>1500 °C) relative to those generated at ambient mid-ocean ridge conditions (~1350 °C). Earth's mantle has also appreciably cooled during its history due to heat loss and decrease in radioactive heat production. Therefore, the source temperatures of modern day basalts are substantially lower than those produced during the Archean (>2.5 Ga), as recorded by komatiites (>1700 °C). Here, we provide evidence that the ~90 Ma Galapagos-related Tortugal Suite accreted in Costa Rica not only record mantle potential temperatures as high as ancient Archean komatiites (~1800 °C), but we also collected the highest olivine-spinel crystallization temperatures ever reported in the literature (1600 °C). Komatiite occurrences were common during the Archean due to overall higher ambient mantle temperatures, yet our new discovery suggests that anomalously hot domains (likely in contact with the Earth's core) survived billions of years of mantle convection.